Chapter 4

Framework for Protecting and Managing Wetlands Using Best Available Science

4.1 Introduction

This chapter outlines a four-step framework for developing and implementing approaches to wetland protection and management by local governments. This chapter introduces the four steps of this framework and the feedback loop called "adaptive management." Following chapters describe each step in more detail. Examples and additional information are provided in the appendices.

The framework is an adaptation of one developed for the *Statewide Strategy to Recover Salmon* (Washington State Joint Natural Resources Cabinet 1999). The framework incorporates the findings of the synthesis of the science from Volume 1, such as using landscape analysis to guide the decision-making process when developing plans, policies, codes, ordinances, and non-regulatory approaches to protecting and managing wetlands. One goal of the framework, as presented here, is to help local governments integrate all of their activities relating to wetlands so they can work together. The integration of analyses, planning, regulations, and non-regulatory activities by a local government can be considered its "wetland protection program."

The review of the literature in Chapter 2 of Volume 1 emphasizes that wetlands are an integral part of the landscape. Therefore, to protect and manage wetlands and reduce cumulative impacts, local governments need to understand how changes in land use that result from human activities at a landscape scale can affect wetlands at the smaller, site scale. Once such an understanding is developed, it is possible to plan for, and minimize, the impacts of human activities at all geographic scales, and thereby effectively protect wetlands and their functions.

Analyzing the landscape that influences wetlands is a relatively new idea. Planners and managers of natural resources face a challenge in incorporating landscape information into the planning and protection process. Three common questions posed by planners and managers are:

- What are landscape processes and what do we know about them and their interaction with wetlands?
- What tools can be used to most effectively incorporate a landscape perspective into wetland management?
- How do we organize planning and protection activities to incorporate information about the landscape as well as protecting individual wetlands?

The first question is answered in Chapter 5, which describes what is meant by a landscape analysis. The last two questions are answered in the guidance provided in subsequent chapters and appendices in this document. Collectively, the framework for a program to protect wetlands described below can help minimize cumulative impacts.

Key terms used in this document to describe processes and functions

Landscape processes - Environmental factors that occur at larger geographic scales, such as basins, sub-basins, and watersheds. Processes are dynamic and usually represent the movement of a basic environmental characteristic, such as water, sediment, nutrients and chemicals, energy, or animals and plants. The interaction of landscape processes with the physical environment creates specific geographic locations where groundwater is recharged, flood waters are stored, stream water is oxygenated, and pollutants are removed, and wetlands are created.

Wetland functions - The physical, biological, chemical, and geologic interactions among different components of the environment that occur within a wetland. There are many valuable functions that wetlands perform but these can be grouped into three categories: functions that improve water quality, functions that change the water regime in a watershed such as flood storage, and functions that provide habitat for plants and animals.

4.2 Four-Step Framework for Protecting and Managing Wetlands

The framework for protecting and managing wetlands is designed to provide a number of opportunities to incorporate landscape information into decision-making at the planning stages as well as into decisions regarding individual wetlands. The four steps of the framework include:

1. Analyzing landscape processes that influence wetland resources (called "landscape analysis"), as well as processes that occur at the scale of the site itself

2. Prescribing solutions for protecting and managing wetlands based on information from Step 1 (such as developing policies, plans, codes, ordinances, and non-regulatory approaches, etc.)

3. Taking actions to implement the solutions (such as applying regulations at individual wetlands, restoring wetlands, and providing non-regulatory incentives)

4. Monitoring the results of the actions taken and the effectiveness of the solutions (such as tracking acreage and functions of wetlands lost and gained and determining whether plans and programs are being implemented); this information will help determine if cumulative impacts are occurring

The four-step framework should be iterative and ongoing. If the data collected through monitoring in the fourth step indicates that wetlands are not being adequately protected and cumulative impacts are occurring, the management actions need to be revised accordingly. Evaluation of the monitoring data initiates a feedback loop called adaptive management.

Figure 4-1 conceptually illustrates the four-step framework that can be used by local governments to develop and implement effective approaches to protecting wetlands and other critical areas. The first two steps—analyzing the landscape and its wetlands and prescribing solutions—can be considered long-term planning, and the second two—taking actions and monitoring results—as implementation. As mentioned previously, an additional component is the feedback loop, called adaptive management. This is the process of assessing what has or has not been effective and making modifications based on these insights.

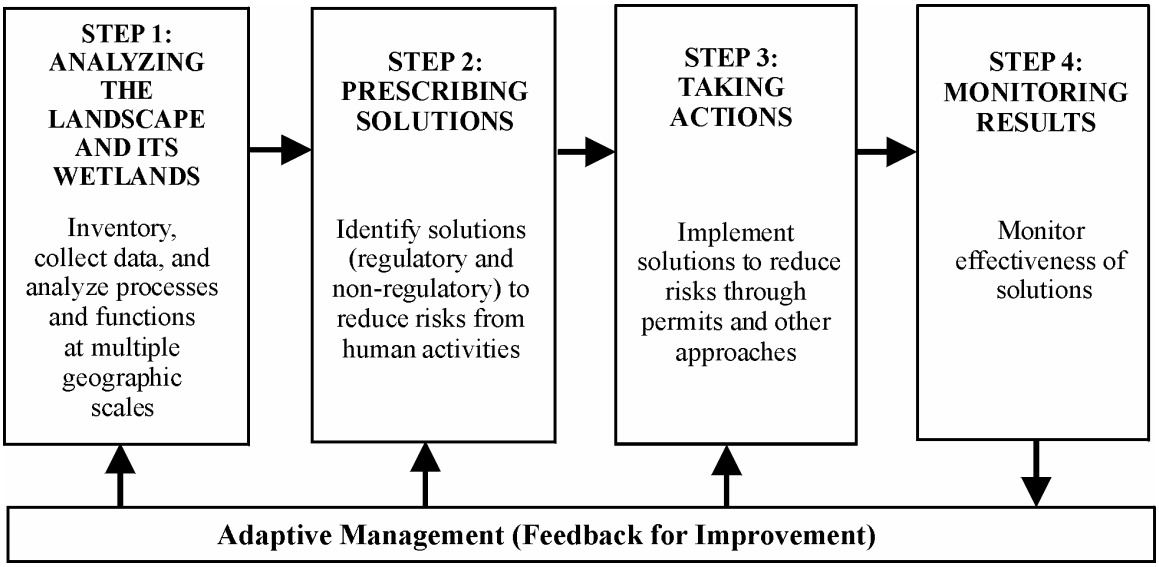


Figure 4-1. A suggested framework for local governments to use in protecting and managing wetlands. These four steps serve as the framework for discussions in this volume and are reproduced at the beginning of each chapter.

4.2.1 Incorporating Different Geographic Scales in the Four-Step Framework

The synthesis of the science presented in Volume 1, and the ecological principles listed in Chapter 1 of this volume, indicate the need for analyzing, planning, and managing at a landscape scale as well as at the scale of individual sites. Therefore, the words used to describe different scales must be clarified to provide a "common language."

Local governments can protect and manage wetlands at different geographic scales. Three geographic scales are discussed in this document. These are the *contributing landscape***,** the *management area*, and the *site*, described in the box below**.** Figure 4-2 provides an example of these three geographic scales.

Geographic scales discussed in this document

The ***contributing landscape*** is the geographic area within which the landscape processes that influence the functions or structure of wetlands located in a *management area* (defined below) occur. A contributing landscape may span jurisdictional boundaries and even span several watersheds (see Figure 4-2). Given that the contributing landscape may cross jurisdictional boundaries, efforts to protect the wetlands need to be coordinated and integrated with programs of other local governments. Because most ecosystems are linked across the landscape, it is important that measures to protect wetlands are coordinated with measures for protecting other resources including riparian areas, floodplains, estuaries, shorelines, and fish and wildlife habitat.

The ***management area*** is the geographic area for which plans and regulations are being developed by a local government. The management area is usually a subset of the contributing landscape because it may be based on political boundaries (e.g., a jurisdiction such as a city), or it may be defined geographically to include a specific Water Resource Inventory Area (WRIA), basin, or sub-basin in a county.

The ***site*** is the area encompassed within the boundary of a single wetland. It, too, may span private property lines or jurisdictional boundaries.

In Figure 4-3, each of the four steps of the framework described earlier is divided into a series of actions that would be undertaken at each of these three geographic scales.

Steps 1 through 4 of the framework are described in detail following the figures.

Figure 4-2. An example of contributing landscape, management area, and site scales.

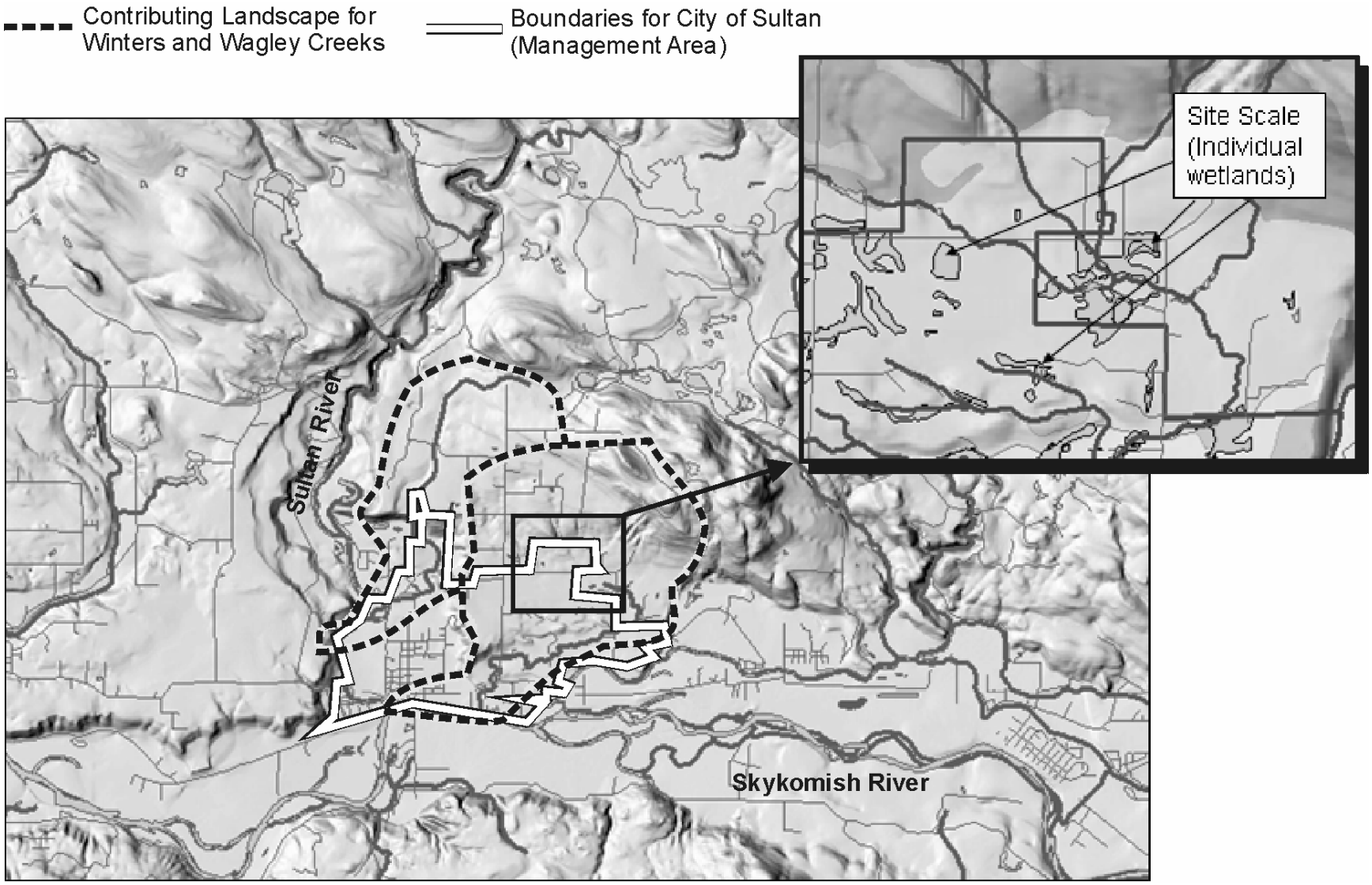
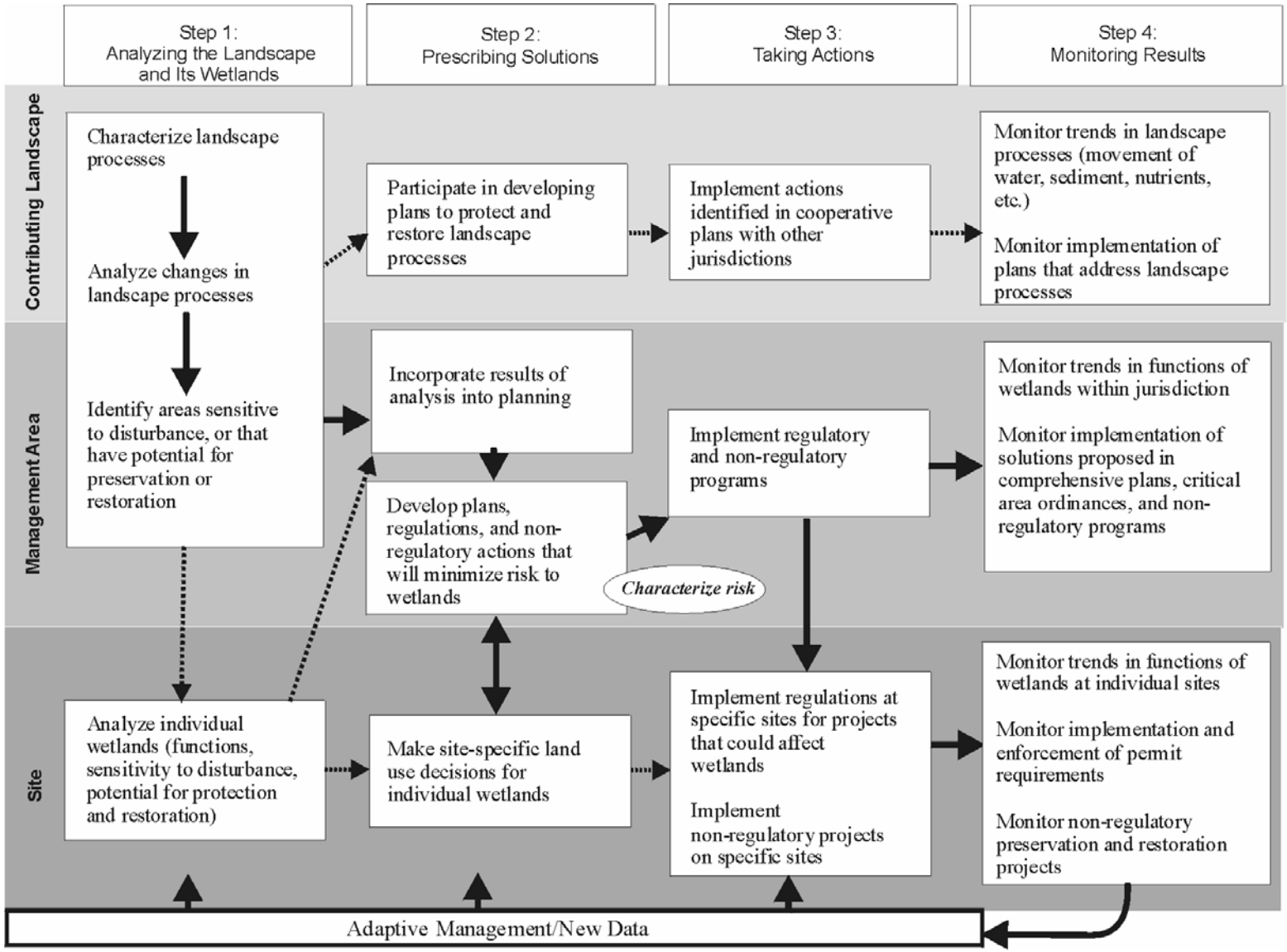


Figure 4-3. Four-step framework incorporating the three geographic scales. Solid arrows represent the process that should be undertaken in developing comprehensive plans and critical areas ordinances. Dashed arrows show additional pathways that can be followed to enhance a protection and management program for wetlands.



4.2.2 Step 1: Analyzing the Landscape and Its Wetlands (Landscape Analysis)

Step 1 involves a *landscape analysis*, which is needed to understand landscape processes and their influence on wetlands. A landscape analysis provides important information that forms the basis of a program to protect wetlands. For example, information from a landscape analysis is crucial in developing comprehensive plans (see Chapter 7) or for planning under an Alternative Futures approach (see Chapter 6). The analysis is applicable to all types of planning done at the scale of the watershed, sub-basin, contributing basin, or site. For example, a landscape analysis can be used to interpret an analysis of the functions of an individual wetland when a change in land use is being considered.

As will be discussed in Chapter 5, a landscape analysis is more complex than what is typically required for a wetland inventory, though the two share some similarities. When doing a landscape analysis, it is recommended that annotated maps be produced that identify areas of critical concern for managing wetlands and their contributing landscape. A series of annotated maps can summarize complex geographic information and provide a scientific basis for establishing land-use designations and in making other decisions about land use. The information can be used in evaluating the relative impacts for a range of alternative scenarios of future development, such as Alternative Futures, that are created in Step 2.

The paragraphs below briefly describe Step 1 at the various geographic scales shown in Figure 4-2. The process for the landscape analysis is described in detail in Chapter 5.

4.2.2.1 Analyses of the Contributing Landscape and the Management Area

The analyses of the contributing landscape and the management area are similar. The difference in the analyses for these two geographic scales is more an issue of resolution than of approach. If the management area is smaller than the contributing landscape, the analysis of the management area can make use of more detailed information, such as detailed wetland inventories and ratings. Local jurisdictions can then develop a more detailed program and have better assurance that the risks to their wetlands are minimized. The same tools and methods, however, can be used at either geographic scale.

The purpose of the analysis at either scale is to develop an understanding of landscape processes that can affect wetland functions. This includes understanding the movement of water, nutrients, sediments, and toxic compounds, and how wetlands that function as habitat are affected by fragmentation of the landscape. It involves inventorying wetland resources, identifying where critical landscape processes occur, and determining how those critical processes have been modified by human activities. From this understanding, one can then determine how these landscape processes may have been changed in the past, and how they might change with future development.

There are two main goals of the landscape analysis. The first goal is to identify locations within the contributing landscape and the management area where landscape processes could be negatively influenced by human land uses (e.g., paving areas that provide groundwater recharge). When planning future changes in land use, these areas can be considered sensitive and in need of specialized management approaches because changes in these locations can be a major cause of cumulative impacts. These areas may not necessarily include only wetlands but may encompass important upland areas that influence wetlands (e.g., areas where groundwater is recharged or corridors of undisturbed uplands that connect wetlands).

The second goal is to identify areas where landscape processes have been degraded but could be repaired, such as through wetland restoration. Planning for restoration could help offset unavoidable impacts identified through the planning process.

This information is used during Step 2 (Prescribing Solutions) and Step 3 (Taking Actions).

4.2.2.2 Analyzing Wetlands at the Site Scale

The main goal of the analysis at the site scale is to understand the functions of an individual wetland and how that wetland interacts with the landscape. This analysis can occur at two different times in the planning and regulatory process: during comprehensive planning and during review of permits for individual projects.

If a local jurisdiction's program to protect and manage wetlands involves preservation or restoration, then individual wetlands will need to be analyzed. Information from the analysis can be used during comprehensive planning (Step 2) to identify those wetlands most suited for preservation and restoration.

The functions of individual wetlands are also often analyzed when permits are sought to alter a wetland. It is, therefore, important for local governments to establish what will be required for site-specific analysis of wetlands during Step 2, when administrative rules, guidance, or regulations are developed (Chapter 8). For example, the requirements should state what must be included within wetland reports and plans for compensatory mitigation. The local jurisdiction should also consider methods for assessing wetland functions and for establishing ratings, buffers, and mitigation ratios. Site-specific analysis is usually the responsibility of the applicant who is proposing changes to a specific wetland.

For further guidance on Step 1, Analyzing the Landscape and Its Wetlands, see Chapter 5 and Appendices 5-A through 5-C of this volume.

4.2.3 Step 2: Prescribing Solutions

Step 2 describes the processes by which local governments develop solutions to protect and manage wetlands within their jurisdiction. The goal of Step 2 is to identify means for incorporating the results of the landscape analysis in Step 1 into effective planning, regulatory, and non-regulatory tools. This is the step in which Smart Growth planning approaches, such as Green Infrastructure or Alternative Futures (discussed in Chapter 6), can be applied and when comprehensive plans, critical areas ordinances, shoreline management plans, restoration plans, and incentives for conservation are typically developed.

4.2.3.1 Prescribing Solutions at the Scale of the Contributing Landscape

To develop solutions for a contributing landscape, which often extends outside the regulatory authority of a local jurisdiction, the jurisdiction will need to coordinate with other, contiguous governments. In reality, however, adjacent jurisdictions may not share the same values or priorities. Because the ability of a local jurisdiction to plan for geographic areas outside of its purview may, therefore, be limited, this document only provides general guidance at this time.

For areas of the contributing landscape that fall within the management area, the process of prescribing solutions is the same as for the management area, as described below.

4.2.3.2 Prescribing Solutions at the Scale of the Management Area

Solutions for protecting and managing wetlands within the management area can be prescribed in many forms. Generally, they include policies contained within comprehensive plans or community plans; codes (such as zoning) and ordinances (including those for critical areas and clearing and grading); stormwater management plans; shoreline master programs; non-regulatory approaches, such as preservation and restoration plans; and incentives for conservation, such as tax relief.

The approach proposed here is to plan for future development and the protection of wetlands by analyzing different alternative scenarios (called Alternative Futures) in terms of their impacts on wetlands and landscape processes. These scenarios should include both general planning approaches, such as different patterns of zoning, and more specific approaches, such as different widths of buffers for wetlands with different ratings. The local government usually incorporates other factors into the scenarios based on the priorities of citizens for their communities. (See Chapter 6 for further discussion.)

The effects of the different scenarios can be compared and evaluated to determine which solution might reduce or limit the impacts to landscape processes. Analyses of scenarios are an important way to summarize detailed scientific information, and they can be very helpful in decision-making.

Step 2 is also the step at which a jurisdiction should ensure consistency between various policies, plans, and regulations administered by the jurisdiction that may influence wetland resources. For example, a grading code may have to be modified to reflect considerations for wetlands or their buffers.

4.2.3.3 Prescribing Solutions at the Site Scale

Prescribing solutions at the site scale involves developing ways to protect wetlands which require tailored protection that is different from the protection afforded to most other wetlands through critical areas regulations. These wetlands are often called "wetlands of local significance." They may include wetlands with a high value for recreation, aesthetics, potential for restoration, or potential as mitigation banks; or they may be crucial to supporting a landscape process, such as aquifer recharge.

The solutions for protecting these wetlands can be specified in advance by using policies in the comprehensive plan or community plans or even site-specific or wetland-type-specific regulatory language. For example, the City of Everett identified specific actions at individual wetlands at the mouth of the Snohomish River estuary that could be taken to restore landscape processes (City of Everett 1997). There was a high probability of success with an important increase in functions.

For guidance regarding tools for Step 2, Prescribing Solutions, see Chapters 6 through 9 of this volume.

4.2.3.4 Characterizing the Risk from Proposed Solutions

A characterization of risks should be used to evaluate the different solutions being suggested for protecting and managing wetlands. Such a characterization provides a way to develop, organize, and understand the decisions being made about future land uses. It also enables decision-makers and the public to make more informed decisions about land uses and wetland resources. Solutions that cause a higher risk to the wetland resource because they are driven by other societal needs can be balanced by solutions that reduce the risks (e.g., through restoration). Avoiding impacts and maintaining functions, however, is generally more cost effective and less risky than trying to replace functions (see Volume 1 and Chapter 6 of this volume for further discussion).

For guidance on characterizing the risk from proposed solutions see Chapter 10 of this volume.

Prescribing solutions incorporating shoreline planning

Solutions for protecting and managing wetlands can be provided in the context of both the Growth Management Act (GMA) and the Shoreline Management Act (SMA). The goal of Step 2 is to incorporate the results of the landscape analysis in Step 1 into plans, regulations, or other actions that will protect wetlands.

The SMA was adopted by Washington's public in a 1972 referendum "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." One of the policies in the SMA is to protect shoreline natural resources including "…the land and its vegetation and wildlife, and the water of the state and their aquatic life…" Some wetlands, therefore, are protected by both the SMA and the GMA. In 1995, the Legislature amended the GMA and the SMA to partially integrate the two statutes (1995 c 347). The amendments incorporate the goals and policies of the SMA as the 14th goal of the GMA; specifically designating the goals and policies of a shoreline master program (SMP) as an element of a local government's comprehensive plan, and designating the balance of the SMP as a segment of the jurisdiction's development regulations (RCW 36.70A.480). In 2003 the Legislature added a requirement that new SMPs must provide a level of protection to critical areas within shoreline jurisdiction that is "at least equal" to the level of protection provided to critical areas under the local government's critical areas ordinances.

On December 17, 2003, Ecology adopted new guidelines for SMPs to implement the revisions to the SMA. The guidelines provide a process for local jurisdictions to implement the policy of the SMA of protecting natural resources of shorelines through the protection and restoration of ecological functions (and environmental processes) necessary to sustain these natural resources. The guidelines specifically state that effective management of shorelines depends on sustaining the functions provided by: 1) ecosystem-wide processes (i.e., flow and movement of water, sediment, and organic materials and movement of fish and wildlife; these are called landscape processes in this volume); and 2) individual components and localized processes such as those associated with shoreline vegetation, soils, and water movement through the soil and across the land [WAC 173.26.201(2)(c)]. The guidelines incorporate the use of scientific knowledge of environmental processes (physical, chemical, and biological processes) that affect the ecological functions of shorelines (and their associated wetlands). Thus, the guidelines for preparing SMPs include an assessment of many of the same environmental processes that are outlined in this volume.

Further, the new guidelines require that SMP policies and regulations ensure "no net loss" of ecological functions necessary to sustain natural ecosystems of shorelines. Updated SMPs must regulate new development in a manner that is protective of existing ecological functions and provide policies that "promote restoration of impaired ecological functions" (WAC 173.26.201(2)(c) and (f)).

The process for preparing an updated SMP is compatible with the four-step framework outlined in this document. The rules (WAC 173.26.201(3)) spell out a general process for updating SMPs that includes: comprehensive inventory of shoreline conditions; characterization and analysis of functions and ecosystem-wide processes; development of shoreline policies, regulations, and environment designations; and development of goals, policies, and actions for the long-term restoration of impaired shoreline ecological functions. The guidance for analyzing the aquatic resources, developing solutions, implementing the solutions, monitoring and adaptive management provided in this document can prove useful to jurisdictions planning under the SMA.

4.2.4 Step 3: Taking Actions

Step 3 ensures that the solutions developed and adopted in Step 2 are effectively implemented through taking actions at the different geographic scales. Examples of taking actions include:

- Implementing regional, subarea, or community plans on the ground
- Applying critical areas and clearing and grading ordinances at specific wetland sites when a development is proposed
- Restoring or preserving wetlands identified in a restoration plan through a landscape analysis
- Setting up a Public Benefit Rating System to provide tax relief for landowners with wetlands (see Chapter 9 for more information)

4.2.4.1 Taking Action at the Scale of the Contributing Landscape

Taking action at the scale of the contributing landscape requires adequate funding and coordination over time. Although the benefits can be great if the solutions are carried out, the challenges are great as well. For example, of the three regional plans that have been developed to protect wetlands—the Everett Snohomish Estuary Wetland Integration Plan (SEWIP) (City of Everett 1997), the Mill Creek Special Area Management Plan (SAMP) (U.S. Army Corps of Engineers 1997), and the Port of Skagit Wetland Industry Negotiations (WIN)—only one (Skagit WIN) was ever adopted and implemented. (For more information on the Skagit WIN contact the Port of Skagit County in Burlington, Washington.)

4.2.4.2 Taking Action at the Scale of the Management Area

Taking action to implement plans, regulations, and non-regulatory approaches adopted by a jurisdiction for its management area is critical to protecting wetlands. The scientific literature reviewed for Volume 1 indicated that one of the major reasons why the functions and values of wetlands continue to be degraded is a lack of resources to implement and monitor proposed solutions.

In the case of a critical areas ordinance for wetlands, an adequate number of staff is needed. The staff should be trained to review permit proposals and enforce the conditions placed on those proposals to ensure that wetlands are protected as planned. This holds true especially for compensatory mitigation. Chapter 6 of Volume 1 highlights the fact that many compensation projects designed to replace wetland functions lost through development have failed in part because of a lack of regulatory oversight and follow-through. Likewise, plans that call for restoration need staff and sources of funding to implement the plans, acquire sites, and monitor the efforts.

4.2.4.3 Taking Action at the Site Scale

Taking action at the site scale means applying the management measures identified for a specific wetland; for example, an individual wetland that is restored using a plan developed for a management area. Implementation at the site scale also requires monitoring the compliance and effectiveness of compensatory mitigation or non-regulatory actions taken at individual sites.

For further discussion of Step 3, Taking Actions, see Chapter 11 of this volume.

4.2.5 Step 4: Monitoring

Monitoring at all three geographic scales (contributing landscape, management area, and site) should be an integral part of a strategy to protect and manage wetlands. It is a key step in determining whether cumulative impacts have actually been minimized during Step 3, Taking Action. Monitoring should address the following central question: *Are the actions taken by a local jurisdiction effectively protecting or restoring the functions and values of the wetlands within its purview and thereby addressing cumulative impacts?*

Local jurisdictions cannot determine whether their solutions (developed in Step 2 and implemented in Step 3) are actually protecting wetlands without collecting data that monitor the success of their approach at the three geographic scales. Monitoring whether adequate protection has been achieved, followed by any needed corrective action, is especially critical. All the information collected to date and reviewed in Volume 1, indicates that there is continued loss of wetlands and their functions and values (cumulative impacts).

Monitoring associated with assessing the protection and management of wetlands by local jurisdictions can be divided into three categories:

- **Monitoring the effectiveness of actions taken to protect and manage wetlands** to determine how well the overall approach (including all solutions) is meeting the goals to protect and manage wetlands at all geographic scales
- **Monitoring the actions taken to implement** the regulatory and non-regulatory solutions developed at all geographic scales
- **Monitoring trends** regarding changes in landscape processes and the level of performance of the functions provided by wetlands at the site scale (i.e., monitoring cumulative impacts)

If the functions and values of wetlands are not adequately protected, managers need to know whether this results from inadequate implementation, inadequate standards, or inadequate strategies. Therefore, all three aspects of monitoring are important in providing feedback to guide future decision-making.

For further discussion of Step 4, Monitoring, see Chapter 12 of this volume.

4.2.6 Adaptive Management

Adaptive management—the feedback loop—is based on a review of the information collected through the monitoring step and a determination of what changes are necessary to improve protection when goals are not met. In this way, future management, policies, and regulations can be more effective in protecting the wetland resource (Washington State Joint Natural Resources Cabinet 1999). Scientists agree that some of the continued degradation of the functions and values of natural systems such as wetlands is a result of a lack of monitoring and adaptive management (Dale et al. 2000). This aspect of protecting and managing wetlands is, therefore, vital to successfully protecting wetlands over time.

The key element of adaptive management is a commitment to periodically revisit the four steps in the framework described earlier. Monitoring should provide new data and information that feed back into the analysis the landscape and its wetlands (Step 1). As the data are analyzed, new information can be generated that may require changing the solutions prescribed (Step 2) and the actions that need to be taken (Step 3). The effectiveness of the new solutions and actions then also needs to be monitored (Step 4), and the cycle repeated over time.

For further discussion of Adaptive Management, see Chapter 12 of this volume.